

As shown in Appendix A, please cancel Claim 33, drawn to a catalyst composition. Claims 34 to 36, drawn to an oxidation process, have also been canceled, without prejudice, hereinabove.



Claims 1 to 32 remain pending in the application. Claims 1, 2, 3, 12, 14, 17, 18, 19, 20, 23, 24, 25, and 30 are amended, as shown in the appendices.

#### REMARKS

##### A. Concerning the Restriction Requirement Under 35 U.S.C. 121

Restriction is required under 35 U.S.C. 121 to one of the following inventions:

Group I. Claims 1-33, drawn to a process of making a product and the product prepared therefrom; or

Group II. Claims 34-36, drawn to a process of oxidizing an olefin.

Applicants have elected without traverse Group I, Claims 1-33, drawn to a process of making a product and the product prepared therefrom. Accordingly, Applicants have canceled without prejudice Claims 34 to 36 (Group II), drawn to a process of oxidizing an olefin.

In addition, Claim 33, drawn to the product, has been canceled by amendment hereinabove. Claims 1 to 32, drawn to a method of making a product, remain pending in the application.

With respect to the inventorship of the elected claims, the undersigned, who has made a reasonable inquiry into the matter, believes that the inventorship is correct as presently named. No correction of inventorship is anticipated.

##### B. Concerning the Claim Amendments

Claim 1 is amended to clarify the meaning of the words "wherein the reducing agent and/or the catalyst support comprise titanium." The amended language is recited as follows: "wherein the reducing agent comprises titanium, or the catalyst support comprises titanium, or both the reducing agent and catalyst support comprise

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titanium". Support for this amendment is found at page 5, lines 8-16 and 18-27; and at page 9, lines 1-2, of the specification.

Claims 2, 12, 14, 18, 19, 23, and 25 are amended to incorporate correct Markush language.

Claims 3, 17, and 20 are amended to incorporate correct antecedent basis.

Claim 24 is amended to replace the term "metal(s)" with "metal or metals". Support for this amendment is found at page 15, line 26, of the specification.

Claim 30 is amended to replace the term "optional" with the term "additional". Support for this amendment is found at page 15, lines 25-27; at page 17, line 22 and lines 30-33; and at page 18, lines 6-9, of the specification.

As noted in Section A hereinabove, Claims 33 to 36 have been canceled.

### **C. Concerning the Claim Objections**

Claim 23 is objected to because "1" and "2" are used to refer to groups in the Periodic Table. The Examiner suggests replacement with - - I - - and - - II - -. In reply, Applicants observe that the claims are consistent with Applicants' specification. Refer, for example, to the specification at page 15, lines 31-34, continuing onto page 16, line 2, wherein Arabic numerals (i.e., 1, 2, 3, etc.), not Roman numerals (e.g., I, II, etc.), are used to identify the groups of the Periodic Table. The claims as filed are also consistent with "new notation," i.e., Arabic numerals, used in some Periodic Tables, for example, the Periodic Table referenced at page 15, line 34, of the specification (*CRC Handbook of Chemistry and Physics*, 75<sup>th</sup> edition, CRC Press, 1994, *copy enclosed*). While we are mindful of the Examiner's preference for Roman numerals, Applicants believe that Claim 23 should not be amended, because the present recitation of Arabic numerals is consistent with the specification and acceptable in the art.

**D. Concerning the Rejection of Claims 1-33 Under 35 USC 112 (second paragraph)**

Claims 1-33 stand rejected under 35 U.S.C. 112 (second paragraph) for allegedly failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The rejection cites Claim 1, lines 3-4, in particular, the words: "the [reducing] agent and/or the catalyst support comprise" as being unclear. Applicants have amended Claim 1 to delete the offending language. Substituted therefor is the phrase "the reducing agent comprises titanium, or the catalyst support comprises titanium, or both the reducing agent and the catalyst support comprise titanium."

The rejection cites Claim 24, "promoter metal(s)" as unclear. The rejected language has been deleted in Claim 24 and replaced with the words "promoter metal or metals".

The rejection cites Claims 2, 12, 14, 18, 19, 20, 23, and 25 as reciting improper Markush groups. Claims 2, 12, 14, 18, 19, 23, and 25 have been amended hereinabove to recite proper Markush language, i.e., ---selected from the group consisting of---. Claim 20 does not appear to require Markush language, so it is not amended.

The rejection cites Claims 3, 17, and 20 for reciting various terms ("the gold loading," "the loading," "the titanium loading") without proper antecedent basis. Claims 3, 17, and 20 have been amended hereinabove to eliminate the problems with antecedent basis.

The rejection cites Claim 30, the term "optional," as indefinite. Applicants believe that the term "optional" refers to a limitation that may be either absent or present, so the claim is clear. Nevertheless, Claim 30 is amended to replace the word "optional" with the word "additional".

In view of the above amendments, all of claims 1-33 are clear and definite. It is therefore requested that the rejection under 35 U.S.C. 112, second paragraph, be withdrawn.

**E. Concerning the Rejection of Claims 1-9, 18, 20, 22-27, and 29-33 Under 35****U.S.C. 102(b)**

Claims 1-9, 18, 20, 22-27, and 29-33 stand rejected under 35 U.S.C. 102(a) as allegedly being anticipated by Haruta et al. (US 5,051,394, hereinafter "Haruta '394"). The Examiner asserts that Haruta '394 discloses a method for production of ultra-fine gold oxides comprising adding a gold compound with a carboxylic acid and a reducing agent, using a titanium oxide carrier." The Examiner cites various locations of Haruta '394 as reciting various aspects of the claimed process. This rejection, as it might apply to amended Claims 1-9, 18, 20, 22-27, and 29-32 is traversed for the following reasons. (Claim 33 has been canceled hereinbefore.)

**1. Summary of the Invention**

The instant application pertains to a process of preparing a catalyst composition comprising gold on a titanium-containing support, such as a titanium oxide or a titanosilicate. The process comprises impregnating a gold compound, such as chloroauric acid, and a reducing agent onto a catalyst support under conditions sufficient to prepare the catalyst composition. The claims require that either the reducing agent, or the catalyst support, or both the reducing agent and the catalyst support contain titanium. As a first example (1) a gold compound and an organic reducing agent, such as a carboxylic acid or an alcohol, may be impregnated onto a catalyst support containing titanium, such as titanium oxide or a titanosilicate. As a second example (2) a gold compound and a reducing agent containing titanium, such as an organotitanium compound or a titanium coordination compound, e.g., titanyl acetate, may be impregnated onto a catalyst support that does not contain titanium, such as silica. As a third example (3) a gold compound and a reducing agent containing titanium, such as an organotitanium compound or a titanium coordination compound, may be impregnated onto a catalyst support that also contains titanium, such as titanium oxide or a titanosilicate.

## 2. Cited Prior Art

Haruta '394 discloses a method of preparing a composition comprising ultra-fine gold particles immobilized on a metal oxide, for example, titanium oxide. The reference summarizes at Columns 1 and 2 various precipitation methods (1-5) of preparing catalysts: (1) coprecipitation method, (2) uniform deposition and precipitation method, (3) dropwise neutralization and precipitation method, (4) reductant addition method, and (5) pH-controlled neutralization and precipitation method. In the co-precipitation method taught at Columns 3 and following, an aqueous solution containing a gold compound and a water-soluble metal salt, e.g., titanium salt, is neutralized with an alkali aqueous solution to yield a coprecipitate (essentially a gold hydroxide and metal hydroxide co-precipitate) that codeposits from the solution. A carboxylic acid is added prior to or after formation of the coprecipitate. The coprecipitate is allowed to age and is then separated and heated at a temperature in the range of from 100°C to 800°C to obtain a composition comprising reduced gold particles immobilized on an oxide (e.g., titanium oxide). (Haruta '394, Column 3, lines 14-55; Column 4, lines 25-45; Column 7, lines 9-17)

## 3. Arguments Against the Rejection

The Haruta '394 reference *taken in its entirety* relates to precipitation and coprecipitation methods for preparing a gold-titanium oxide composition. Precipitation/coprecipitation is a well-known technique wherein a solution containing a soluble compound of the desired element is treated with a precipitation agent to cause the formation of a less soluble compound (salt or oxide/hydroxide) of the desired element. When the concentration of the less soluble compound of the desired element exceeds its solubility limit in the solution, the less soluble compound of the desired element settles out of, "precipitates from," the solution as particles. In Haruta '394, an aqueous solution containing a water-soluble gold compound, a water-soluble metal salt (precursor to metal oxide, e.g., titanium oxide), and a carboxylic acid is treated with an alkali hydroxide at controlled pH to cause the hydroxides/oxides of the gold and metal to coprecipitate. Then, in the presence of the carboxylic acid, the precipitate is heated to cause the gold oxide/hydroxide to be converted to ultra-fine

metallic gold particles. Significantly, Haruta '394 is silent with respect to an impregnation method of preparing the catalyst.

The precipitation/coprecipitation method of Haruta '394 disadvantageously requires large amounts of solvent that ultimately must be recovered for reuse, else the method is impractical. As a further disadvantage, Haruta's method requires that pH be controlled throughout the precipitation process, so as to obtain gold of the correct particle size. (Haruta '394, Column 5, lines 27) Controlling pH adds a complexity to the method, which is then not amenable to large-scale operation. More disadvantageously, the precipitation/coprecipitation method must be conducted slowly to ensure precipitation of small gold particle size and proper adherence of gold to the support. As an even further disadvantage, the disclosed coprecipitation/precipitation method does not provide for reproducible control over the amount of gold deposited onto the support. From batch to batch, differing amounts of gold precipitate and adhere to the support. Finally, any gold remaining in solution or precipitating into solution, rather than onto the support, must be recovered, else the gold is wasted.

In contrast, the method of the invention requires an impregnation technique, which differs significantly from the precipitation/coprecipitation methods of Haruta '394. Applicants' impregnation technique involves preparing an impregnation solution containing a soluble compound of catalytic metal (e.g., soluble gold compound) and a soluble compound of reducing agent, and any additional promoter metal or metals, and then simply applying the solution (e.g., wetting) to a catalyst support. In a preferred embodiment, the impregnation involves wetting the catalyst support with the impregnation solution only to the point of incipient wetness. Impregnation, as a technique, is generally known in the catalysis art. The specification, for example, references a description of the impregnation technique in *Heterogeneous Catalysis in Practice*, by Charles N. Satterfield, McGraw-Hill Book Company, New York, 1980, pp. 82-84.

The claimed impregnation method provides many advantages over the precipitation methods of Haruta '394. To start, the claimed impregnation method requires less quantity of solvent as compared with Haruta's precipitation method.

Only the amount of solvent to be applied to the support is needed. There is no need to recover large amounts of excess solvent for reuse. The claimed impregnation method may also beneficially employ non-aqueous solvent; there is no absolute requirement to use water, as is the case with Haruta '394. The claimed impregnation method does not require the complexity of controlling pH throughout the deposition process. As a further advantage, the claimed impregnation method can be conducted more quickly than the precipitation method of the prior art, which requires a longer time. As a further advantage, the claimed impregnation method provides for better control over the amount of gold deposited onto the support. Since a measured amount of gold is applied directly to the support, the quantity of gold deposited is acceptably consistent from batch to batch. Most advantageously, the claimed impregnation method does not require recovery of unused gold from the solution, because no large excess of gold solution is employed and the solution used is directly applied to the support. All of the above distinguishes the claimed method from the method of Haruta '394. Clearly, the claimed method is also significantly more favorable for commercial, large-scale preparations.

The rejection cites a list of specific locations in Haruta '394 that allegedly disclose the claimed subject technology of Claim 2 (specific gold compounds), Claim 3 (atomic ratio of Au/Ti), Claim 4 (reduction with carboxylic acid), Claims 5-7 (carboxylic acids and salts thereof), Claim 8 (at least 1 mol per mol), Claim 9 (citric acid with coprecipitate), Claim 18 (titanium oxide carrier), Claim 20 (0.05 mol titanium sulfate and atomic ratio of Au/Ti), Claims 22-23 (alkali compound to metal salt), Claim 24 (use of sodium carbonate), Claim 25 (magnesium citrate), Claim 26 thorough washing), Claim 27 (use of sodium carbonate), Claim 29 (20-90 deg C), and Claims 30-32 (drying and firing in air at 400 deg C). Applicants vigorously maintain that none of the citations disclose the claimed invention, because all of Claims 2, 3, 4, 5-7, 8, 9, 18, 20, 22-23, 24, 25, 26, 27, 29, and 30-32 depend from Claim 1, which requires impregnation, which is a significantly different technique from the precipitation/coprecipitation technique of Haruta '394. Accordingly, none of Applicants' claims is anticipated by Haruta '394.

For the record, however, we note that Claims 22-24 and 27 require the use of promoter metal or metals, which may include compounds of the Group 1 elements, such as sodium. Haruta '394 teaches the use of sodium hydroxide; but it is merely for the purpose of *adjusting pH by adding base* (OH<sup>-</sup>) to initiate precipitation. Haruta '394 makes no disclosure or suggestion that the *sodium itself* can act as a promoter for the catalyst.

In view of the above, it is submitted that all of amended Claims 1-9, 18, 20, 22-27, and 29-32 meet the novelty requirements of 35 USC 102(b). It is therefore requested that the rejection under 35 USC 102(b) be withdrawn.

**F. Regarding the Rejection of Claims 10-14, 16-17, 19, 21, and 28 Under 35 U.S.C. 103(a)**

Claims 10-14, 16-17, 19, 21, and 28 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Haruta '394, for the reasons of record. This rejection, as it might apply to amended Claims 10-14, 16-17, 19, 21, and 28, is traversed for the following reasons.

The Examiner is reminded that all of amended Claims 10-14, 16-17, 19, 21, and 28 require an impregnation method of preparation that is novel and unobvious over Haruta '394.

With regard specifically to Claim 10, the rejection states that it would be obvious to one of ordinary skill in the art at the time the invention was made to use a titanium salt as a reducing agent, because "Haruta '394 discloses using titanium both as salts in gold compounds and as support materials" and because "Haruta also discloses reducing agents comprising carboxylic acids and salts thereof, giving examples of transition metals."

Claim 10 refers to an impregnation method wherein the reducing agent contains titanium. Claim 21 requires that the reducing agent and support both contain titanium. Haruta's disclosures of titanium as a salt in gold compounds or as a support material are irrelevant to Claims 10 and 21, which each require a titanium-containing reducing agent. It is well known that a reducing agent functions in a significantly



different manner from a gold salt or a catalyst support. Further to the point, Haruta '394 teaches only eight metals for salts of carboxylic acids: "potassium, sodium, magnesium, strontium, barium, manganese, cobalt, and nickel salts of such acids [carboxylic acids]" from a Periodic Table of approximately 68 metals. Haruta '394 makes no teaching, suggestion, or hint that titanium is equivalent to the disclosed eight metals. Accordingly, it would not have been obvious to select titanium-containing reducing agents, such as titanium salts of carboxylic acids. Further, there is no indication whatsoever in Haruta '394 that the reducing agent and the support should *both* contain titanium. Accordingly, amended Claims 10 and 21 are unobvious.

With regard to Claims 11-14, the rejection specifically states that Haruta '394 discloses "using reducing agents comprising carboxylic acids and salts thereof." The rejection appears to imply that titanium salts of carboxylic acids are suggested by the reference. Claim 11 requires that an organotitanium compound is used as the reducing agent, further selected from alkyltitanium and cyclopentadienyltitanium compounds (amended Claim 12). Claim 13 requires that a titanium coordination compound is used as the reducing agent, further selected from titanium alkoxides and titanium carboxylates (amended Claim 14).

Again, the reason for rejection of Claims 11 and 12 is not relevant. Claims 11 and 12 require an organotitanium compound, which as the specification states, contains a titanium-carbon  $\sigma$ -bond or a titanium-carbon  $\pi$ -bond. Titanium carboxylates do not contain either of these types of bonds. Accordingly, Claims 11 and 12 are unobvious. With respect to Claims 13 and 14, Haruta '394 does not motivate the skilled artisan to select titanium as the metal for the carboxylate salt from the large number of metals available in the Periodic Table (nearly 68). Accordingly, Claims 13 and 14 are also unobvious.

With regard to Claim 16, the rejection asserts that Haruta '394 discloses "forming the gold/titania suspension before adding the reducing agent." Claim 16 requires that the gold compound be deposited onto the support prior to deposition of the titanium-containing reducing agent. Again, the citation is irrelevant. In Claim 16

the reducing agent is *not* added to a suspension. Rather, the reducing agent is *impregnated directly onto the support* after impregnation of the gold compound. There is no suggestion in Haruta '394 to replace the suspension with Applicants' claimed impregnation method.

Regarding Claim 17, the rejection specifically asserts that "Haruta '394 discloses the ratio of Au/Ti = 1/19 and 400 ml of 6.0 g/liter metal citrate solution are used." Amended Claim 17 requires a titanium loading of greater than 0.02 weight percent and less than 20 weight percent, based on the weight of the support.

In reply, amended Claim 17 states titanium loading in units of weight percent titanium, based on the weight of the catalyst support. In contrast, Haruta '394 discloses a Au/Ti molar ratio and the amount of metal citrate solution to be used in units of g solution per liter. The measurements and units required by the claim are completely different from the measurements and units taught by Haruta '394. Thus, the reasons for rejection are irrelevant and cannot defeat the claim. Moreover, Haruta '394 pertains to titanium oxide supports (TiO<sub>2</sub>), wherein the titanium constitutes nearly 60 weight percent of the support. This weight percent is outside the claimed range. There is no teaching or suggestion in Haruta '394 to use a titanium-containing reducing agent on a catalyst support in an amount such that the titanium loading is within a range from 0.02 to 20 weight percent, based on the weight of the support.

With regard to Claim 19, the rejection asserts that Haruta '394 discloses a titanium oxide carrier (inherently titania). Amended Claim 19 requires that the *reducing agent* contains titanium and that the catalyst support is selected from silicas, aluminas, aluminosilicates, zirconia, magnesia, carbon, titania, and mixtures thereof. Haruta '394 neither teaches nor suggests a reducing agent containing titanium.

With regard to Claim 28, the rejection asserts that it would be obvious to conduct the impregnation to the point of incipient wetness, because "Haruta '394 discloses impregnation with solution precipitation and in view of Applicants' own admission that such techniques are known in the art." Claim 28 requires the impregnation to be conducted to the point of incipient wetness or a point of lesser wetness.

Applicants vigorously insist that Haruta '394 does not disclose, suggest, or even hint at impregnation, much less impregnation to the point of incipient wetness. Moreover, the fact that a technique is generally known in the art does not mean that the technique can be applied to prepare operable and beneficial hydro-oxidation catalysts of gold on a titanium-containing support. "Obvious to try" is not a valid means for rejection. Moreover, the Examiner's words "discloses impregnation with solution precipitation" confuse two art recognized terms. In impregnation, a solid support is simply wetted with a solution containing a soluble salt or compound of the desired component. In solution precipitation/co-precipitation, a solution of one or more soluble compounds is treated with a precipitating agent, base for example, to coprecipitate salts, or oxides, or hydroxides of the desired metal components. Impregnation and precipitation are generally considered to be exclusive of each other. The correct generic terminology would be "to *deposit* a component onto a support by *either* impregnation *or* precipitation." Claim 28 is clearly unobvious.

As further evidence of the unobviousness of Applicants' claims, the Examiner's attention is directed to page 7 of EP-A1-0,709,360, (Haruta 'EP, copy of record in file, supplied with Applicants' Information Disclosure Statement of June 13, 2000), particularly "Comparative Example 1 of Catalyst Preparation - Preparation of gold-titanium dioxide catalyst by impregnation method"(hereinafter CE-1 CP) and "Comparative Example 1 - Oxidation of propylene with oxygen using comparative catalyst" (hereinafter CE-1). In CE-1 CP, a soluble gold compound, chloroauric acid tetrahydrate, is dissolved in water, and the gold solution is *impregnated* onto titanium dioxide. No reducing agent is used in Haruta EP's preparation. In CE-1 the impregnated gold catalyst, prepared without a reducing agent, is evaluated in the gas phase oxidation of propylene with oxygen in the presence of hydrogen. Haruta 'EP reports:

"The oxidation was found to form absolutely no propylene oxide.

When the reaction temperature was raised, consumption of hydrogen by oxidation alone occurred at temperatures up to 100°C, and hydrogenation of propylene into propane occurred at temperatures exceeding 100°C. Thus, absolutely no formation of

propylene oxide was observed during the reaction at the elevated temperatures.” (Haruta, EP-A1-0,709,360, page 7)

Clearly, Haruta himself teaches away from the impregnation method, in contrast to Applicants’ claims. Proceeding contrary to accepted wisdom in the art is evidence of non-obviousness. *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986)

In contrast, Applicants have discovered a unique and beneficial impregnation method of preparing a catalyst of gold on a titanium-containing support, the method including the impregnation of a reducing agent. When tested in a similar process of oxidizing propylene with oxygen in the presence of hydrogen, Applicants’ catalyst exhibits acceptable activity (propylene conversion, 0.2-3.2 mole percent) and high selectivity to olefin oxide (>90 mole percent) at temperatures above 100°C. See Applicants’ Examples 1-6 in the specification. Desirably, a low water/propylene oxide molar ratio is achieved; and unexpectedly essentially *no* hydrogenation to propane is found in Applicants’ process.

In view of all of the above, it is submitted that Claims 10-14, 16-17, 19, 21, and 28 meet the requirements for non-obviousness. It is therefore requested that the rejection be withdrawn.

**G. Concerning the Rejection of Claims 10-17 under 35 U.S.C. 103(a)**

Claims 10-17 stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Haruta ‘394, as applied to Claim 1 hereinabove, further in view of Hirose et al. (US 5,532,030). Hirose et al. is relied upon for teaching a hydrogenation catalyst containing a reducing agent or an acetylacetonate of a titan salt. The Examiner asserts that “it would have been obvious for one skilled in the art to use the titan acetylacetonate of Hirose et al. as a reducing agent in the catalyst composition of Haruta ‘394, because Hirose et al. discloses his acetylacetonate for use in a catalyst with reducing agent, and Haruta discloses reduction with various organometallic salts.” This rejection, as it might apply to Claims 10-17, including as they have been amended hereinbefore, is traversed for the following reasons.

Claims 10-15 pertain to the impregnation method of preparing a Au/Ti catalyst by use of reducing agents that contain titanium, more specifically, organotitanium compounds, such as alkyltitanium compounds and cyclopentadienyltitanium compounds, or titanium coordination compounds, such as titanium alkoxides and titanium carboxylates, more preferably, titanium acetylacetonate. Claim 16 relates to deposition of the gold compound onto the support prior to deposition of the titanium-containing reducing agent. Claim 17 relates to a titanium loading of from 0.02 to 20 weight percent, relative to the weight of the support.

At the start, it is noted that all of Claims 10-17 require an impregnation technique, which is not disclosed or suggested by either Haruta '394 or Hirose et al. Of equal significance, case law is clear that as initial and minimum standards, each reference cited against the application must qualify as prior art under 35 USC 102 and should be in the field of Applicant's endeavor, or be reasonably pertinent to the particular problem with which the inventor was concerned. *In re Oetiker*, 24 USPQ2d 14443, 1445 (Fed. Cir. 1992) Hirose et al. teaches 48 columns of detailed description of a polyolefin multilayer laminate vessel and packaging material comprising a cycloolefin-based resin as a first layer and an olefin copolymer as a second layer laminated onto the first layer. Hirose et al. teaches a ring-opening polymerization catalyst. Unarguably, Hirose et al. is *not even remotely* connected to the field of Applicants' endeavor or the problem with which the Applicants is concerned. Without some indication in the references that the claimed combination is desirable, the combination of elements from non-analogous sources, in a manner that reconstructs the Applicants' invention only with the benefit of hindsight, is insufficient to present a *prima facie* case of obviousness. *Ex parte Dussaud*, 7 USPQ 2nd, 1818, 1820 (PTO Bd. 1988); *In re Grabiak*, 226 USPQ 870, 872 (Fed. Cir. 1985); *In re Fine*, 5 USPQ 2nd 1596, 1598 (Fed. Cir. 1988).

Buried at Column 26, Hirose et al. teaches the *ring-opening polymerization catalyst*, not a hydro-oxidation catalyst as Applicants' claim. The polymerization catalyst is taught to be:

“composed of a combination of halogenide, nitrate, or acetylacetonate of a metal selected from, for example, ruthenium, rhodium, palladium, osmium, iridium, and platinum, with a reducing agent; *or* a catalyst composed of a combination of a halogenide or acetylacetonate of a metal selected from, for example, titan, palladium, zirconium, and molybdenum, with an organoaluminum compound.”

Hirose, Column 26, lines 25-38, Emphasis added

Nowhere is it taught that the “reducing agent” can be used in combination with titan acetylacetonate. Instead, the reference actually teaches titan acetylacetonate combined with *an organoaluminum compound*. In clear contrast, Applicants claim the use of titanyl acetylacetonate *as a reducing agent* in preparing an *oxidation* catalyst comprising gold on a titanium-containing support for *hydro-oxidation* processes. Clearly, Hirose et al. fails to meet any of the standards set by the courts and therefore must be withdrawn.

Haruta ‘394’s disclosure of titanium as a salt in gold compounds and in support materials is irrelevant, because the claimed reducing agents function in a significantly different capacity and manner from gold salts or catalyst supports. Further, Haruta ‘394 teaches only eight metals for salts of carboxylic acids and does not suggest that titanium is an equivalent. Applicants maintain that there is no motivation whatsoever in Haruta ‘394 to direct the skilled artisan to the selection of titanium-containing reducing agents, more particularly, the claimed organotitanium compounds or titanium coordination compounds.

The rejection applies the combination of Haruta ‘394 and Hirose et al. to Claims 16, drawn to forming the gold/titanium suspension before adding the reducing agent, and to Claim 17, drawn to the specific loading of the titanium on the support as a weight percent. Applicants’ arguments set forth hereinabove have already addressed the salient points related to Haruta ‘394. Hirose et al. adds nothing to render Claims 16 and 17 obvious

In view of the above, it is submitted that amended Claims 10-17 meet the standards for non-obviousness. It is requested that the rejection under 35 U.S.C. 103(a) be withdrawn.

#### **H. Concerning Claim 33**

The Examiner asserts in the restriction requirement that Claim 33, drawn to a catalyst composition, is "not allowable." Applicants do not wish to have the Examiner's remark stand on record without a reply, even if the point is moot. Applicants believe that Claim 33 is patentable. As shown above, Applicants' method of making the composition is clearly novel and unobvious over the methods disclosed in Haruta '394 and Hirose et al. Proving that the composition, itself, is novel and unobvious may require a comparative showing of catalytic activity and selectivity versus the catalyst of Haruta '394, and therefore, may be time-consuming and costly. Applicants do not wish to pursue the point at this time, but reserve the right to refile Claim 33 in a divisional application, if desired.

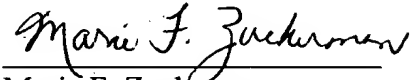
#### **I. Conclusions**

Further to the Office Action of August 8, 2001, it is the opinion of the Applicants that the instant claims are novel and unobvious over all of the references made of record and not relied upon. US 5,506,273 (Haruta et al.) and US 4,113,658 (Geus) relate to precipitation methods of preparing a catalyst, whereas the instant claims relate to an impregnation method of preparing a catalyst. US 5,502,020 (Iwakara et al.) relates to a silver catalyst, whereas the instant claims relate to a gold catalyst. US 5,304,596 (Moriya et al.) relates to a polyolefin catalyst comprising titanium and a reducing agent; but the reference does not disclose gold in combination therewith.

In conclusion, Applicants have elected Claims 1-33, set forth claim amendments, and addressed each issue in the Office Action dated August 8, 2001. Applicants believe that pending amended Claims 1 to 32 now meet all of the

requirements for patentability. A Notice of Allowance is solicited at the Examiner's earliest convenience.

Respectfully submitted,

A handwritten signature in cursive script, reading "Marie F. Zuckerman".

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**APPENDIX A: (Marked-Up Version of Amended Claims)**

Claim 1. (Amended) A process of preparing a catalyst composition comprising gold on a titanium-containing support, the process comprising impregnating a gold compound and a reducing agent onto a catalyst support, wherein the reducing agent comprises titanium, and/or the catalyst support comprises titanium, or both the reducing agent and the catalyst support comprise titanium, under conditions sufficient to prepare the catalyst composition.

Claim 2. (Amended) The process of Claim 1 wherein the gold compound is selected from the group consisting of chlorauric acid, sodium chloraurate, potassium chloraurate, gold cyanide, potassium gold cyanide, diethylamine auric acid trichloride, gold acetate, alkyl gold halides, and alkali aurates.

Claim 3. (Amended) The process of Claim 1 wherein the process is conducted at a gold loading ~~is~~ greater than about 10 parts per million by weight, based on the total weight of the gold and support.

Claim 12. (Amended) The process of Claim 11 wherein the organotitanium compound is selected from the group consisting of alkyltitanium compounds and cyclopentadienyl titanium compounds.

Claim 14. (Amended) The process of Claim 13 wherein the titanium coordination compound is selected from the group consisting of titanium alkoxides and titanium carboxylates.

Claim 17. (Amended) The process of Claim 10 wherein the process is conducted at a titanium loading of the titanium-containing reducing agent ~~is such that the titanium loading is~~ greater than 0.02 weight percent and less than 20 weight percent, based on the weight of the support.

Claim 18. (Amended) The process of Claim 1 wherein the catalyst support is selected from the group consisting of titanium dioxide, titanosilicates, titanium dispersed on silica, promoter metal titanates, titanium dispersed on promoter metal silicates, and mixtures thereof.

Claim 19. (Amended) The process of Claim 1 wherein the reducing agent contains titanium and the support is selected from the group consisting of silicas, aluminas, aluminosilicates, zirconia, magnesia, carbon, titania, and mixtures thereof.

Claim 20. (Amended) The process of Claim 1 wherein the process is conducted at a ~~the~~ titanium loading on the support is of greater than 0.02 weight percent and less than 20 weight percent, based on the weight of the support.

Claim 23. (Amended) The process of Claim 22 wherein the promoter metal is selected from the group consisting of silver, Group 1, Group 2, the lanthanide rare earth metals, the actinide metals of the Periodic Table, and mixtures thereof.

Claim 24. (Amended) The process of Claim 22 wherein the total concentration of promoter metal or metals ~~metal(s)~~ ranges from greater than about 0.01 to less than about 20 weight percent, based on the total weight of the catalyst.

Claim 25. (Amended) The process of Claim 1 wherein the solvent for the impregnation is selected from the group consisting of water, organic solvents, and mixtures thereof.

Claim 30. (Amended) The process of Claim 1 wherein after impregnation and any ~~optional~~ additional steps of washing and treating with a promoter metal, the catalyst is heated.

~~Claim 33. A catalyst composition comprising gold on a titanium containing support, wherein the catalyst is prepared by the process of Claim 1.~~

~~Claim 34. A process of oxidizing an olefin to an olefin oxide comprising contacting an olefin with oxygen in the presence of hydrogen and a catalyst comprising gold on a titanium containing support under process conditions sufficient to prepare the olefin oxide, the catalyst being prepared by the process of Claim 1.~~

~~Claim 35. The process of Claim 34 wherein the olefin is propylene and the olefin oxide is propylene oxide.~~

~~Claim 36. The process of Claim 35 wherein water is produced in a water to propylene oxide molar ratio of less than about 10/1.~~